these fossil-sequences in the world are Siberian and East European Platform[12], Mongolia[13] and China[14], now reinforced by discoveries in the Tal Formation.

Considering the present record to be the extension of the studies carried out earlier[1], it is apparent that the brachiopod assemblage of Early Cambrian (Botomian Stage) constitutes a widely developed chronostratigraphic level in the lower part of the Phulchatti Quartzite Member of Tal Formation in Lesser Himalaya, and with further search can be located in other Synclines of Lesser Himalaya exposing Krol-Tal succession.

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FRICTIONAL CHARACTERISTICS OF LEADED ALUMINIUM BEARING ALLOYS

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ONE of the basic functions of a bearing interposed between two surfaces in relative motion is to reduce the friction between them. During our investigation, frictional characteristics of some leaded aluminium bearing alloys were studied under dry sliding conditions at room temperature using a pin-on-disc type machine[1]. The rise in specimen (cylindrical pin) temperature due to frictional heating near the mating interface was taken as a measure of the frictional resistance of the specimen alloy. An iron-constantan thermocouple was fixed in contact with the test specimen at 2 mm above the mating interface and this was connected to a potentiometer via an ice bath to facilitate measurement of temperature rise of the specimen due to frictional heating. Figure 1 shows the relationship between the sliding distance and temperature rise of the specimen for different alloys. It may be noticed that with increasing sliding distance, a progressive increase in specimen temperature of the base metal occurs. However, as lead is added to aluminium, there is a lower rise in specimen temperature and at or above 10% wt. Pb, little or practically no increase in temperature occurs after the specimen has slid a certain distance. This suggests that lead reduces frictional heating effectively only when it is present in a certain concentration in aluminium base alloys. It is, however, interesting to note that as the lead content of the alloy exceeds 35 wt.%, there is no further decrease in temperature rise of the specimen and it rather increases. The above observations may be explained as follows.

Lead acts as a solid lubricant and reduces friction between the specimen and the steel disc by smearing and forming a thin layer of low shear strength material spread over a stronger substrate. It may be envisaged that in the beginning of the sliding, asperities of the steel disc under the influence of applied load and speed impress the relatively strong matrix of the bearing alloy deeper causing an extrusion and smearing of lead over the surface of the test-pin. In further traverses of the pin, lead is gradually built up over the pin surface and some of it is transferred to the steel disc and is smeared over the wear track. In the next few runs, over the entire pin surface, a uniform film of smeared lead is

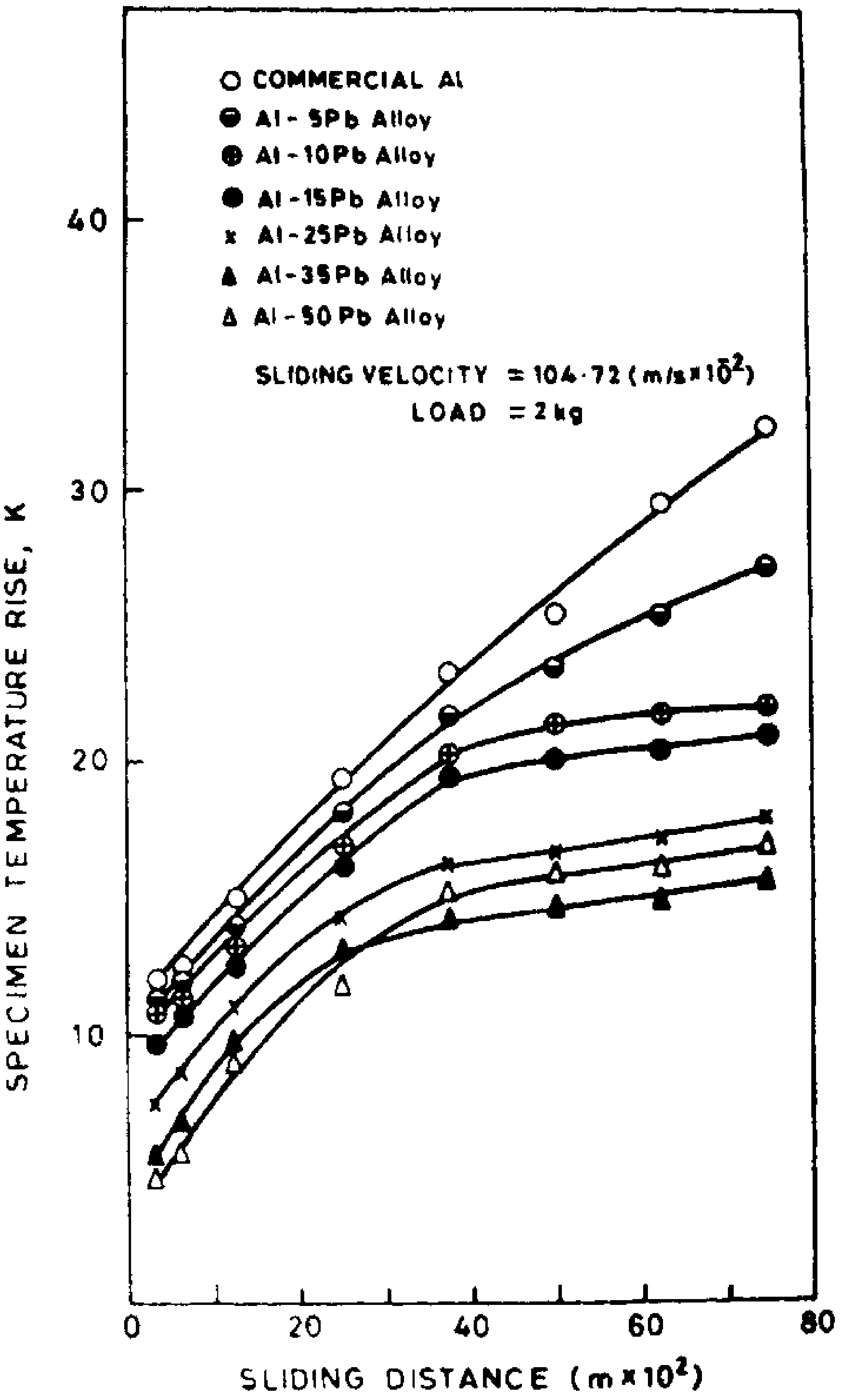

Figure 1. Effect of sliding distance on specimen temperature.

Table 1 *Variation of coefficient of friction with alloy composition after 5 Km of sliding*

Alloy composition	Coefficient friction (μ)
Commercial Al	0.51
Al- 5 Pb	0.48
Al-10 Pb	0.40
Al-15 Pb	0.36
Al-25 Pb	0.30
Al-35 Pb	0.26
Al-50 Pb	0.28

formed causing friction to reduce between the mating surfaces. However, a part of the lead on the wear track is swept by the pin surface to accumulate at the edges of the track and this depleted lead is continuously replenished by further extrusion of lead from the pin surface and its subsequent transfer to the disc. In this process, a uniform and relatively stable film of lead is thus maintained between the mating surfaces causing practically no further increase in temperature of the pin due to frictional heating. However, as has been shown[2] in the case of copper-lead alloys, a minimum thickness of the lead film is required below which the latter is not effective in reducing the friction. Further, with increasing lead content of the bearing alloy, a greater supply of lead is readily available to replenish the local exhaustion of lead and maintain the necessary lead film thickness. This may be the reason why the temperature rise of the specimen decreases as the lead content of the alloy increases from 10 to 35 wt.%. However, when lead is available in excess supply (e.g., in alloys containing > 35 wt.% Pb), it may possibly form too thick a lubricant film of lead, increasing the track depth and the area of contact[2] which enhances the frictional resistance and hence, the frictional heat between the mating surfaces. Friction may also increase at such high lead contents since the bearing alloy becomes mechanically quite weak[3] to facilitate local yielding and welding. That is why a larger increase in temperature of the specimen is recorded when lead exceeds 35 wt.% of the bearing alloy. The measurement of the coefficient of friction for different alloys after the specimen has slid a distance of some 5 km (table 1) also substantiates the above results, since the friction coefficient decreases with increasing lead concentration upto 35 wt.% Pb only. This work thus shows that lead is effective in reducing friction only in the concentration range of 10–35 wt.%.

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